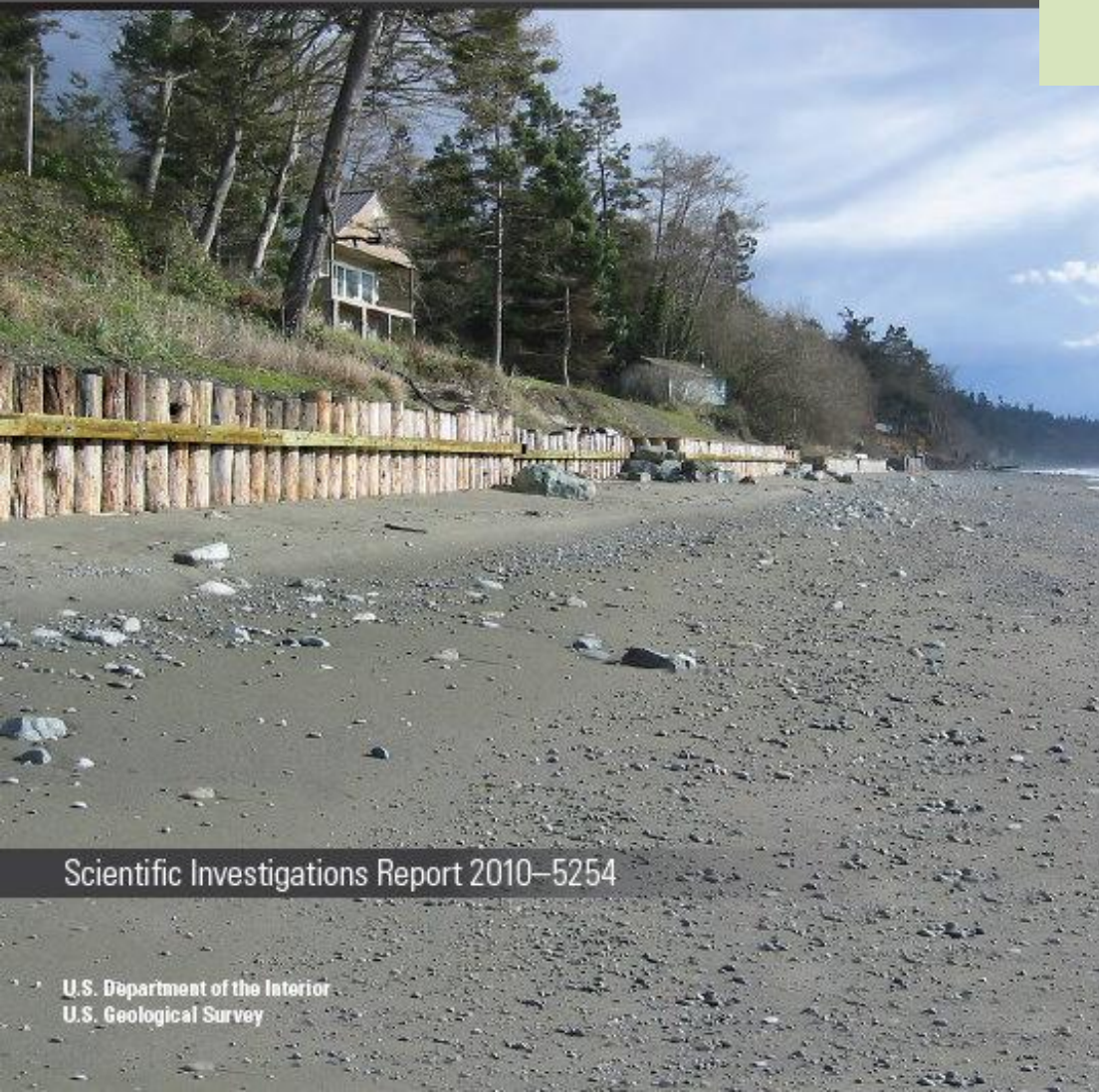


Puget Sound Shorelines and the Impacts of Armoring—
Proceedings of a State of the Science Workshop,
May 2009



Scientific Investigations Report 2010–5254

USGS Report on the Impacts of Shoreline Armoring

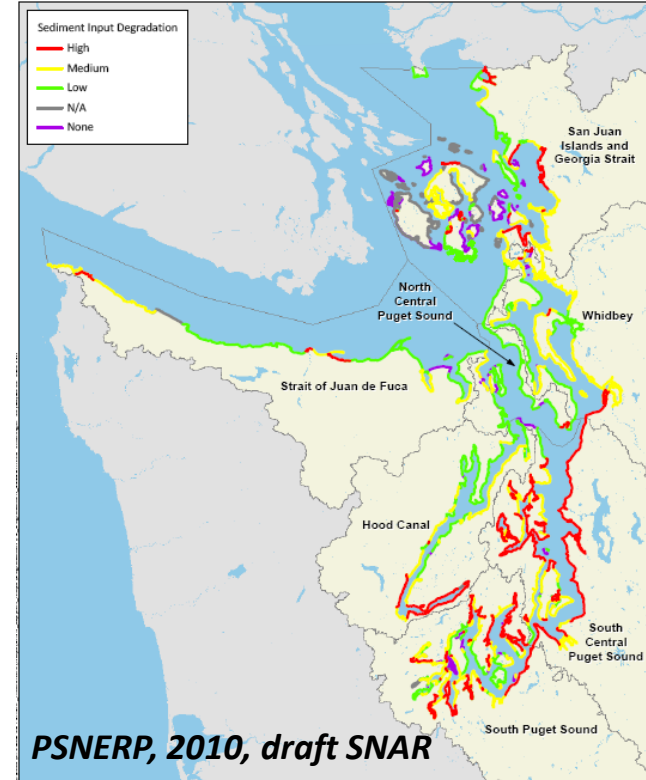
Proceedings of 2009 Technical Workshop

SMP Updaters Meeting
Tukwila
28 July 2011

Hugh Shipman
WA Department of Ecology

Shoreline Armoring on Puget Sound

- **Armoring on Puget Sound is widespread**
 - 28% of 2500 miles armored, about 1-2 miles added each year
- **Increasing concern about possible impacts**
 - Beach loss
 - Ecological resources
 - Public use of the shoreline
- **Challenging Management Issue**
 - Shoreline Master Program Updates
 - PS Partnership
 - Restoration Efforts
 - PS Nearshore Ecosystem Restoration Project (PSNERP)
 - Estuarine and Salmon Restoration Program (ESRP)



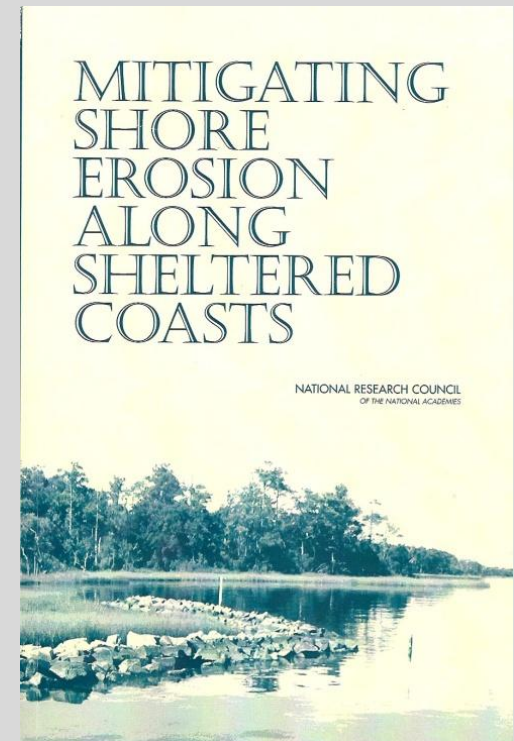
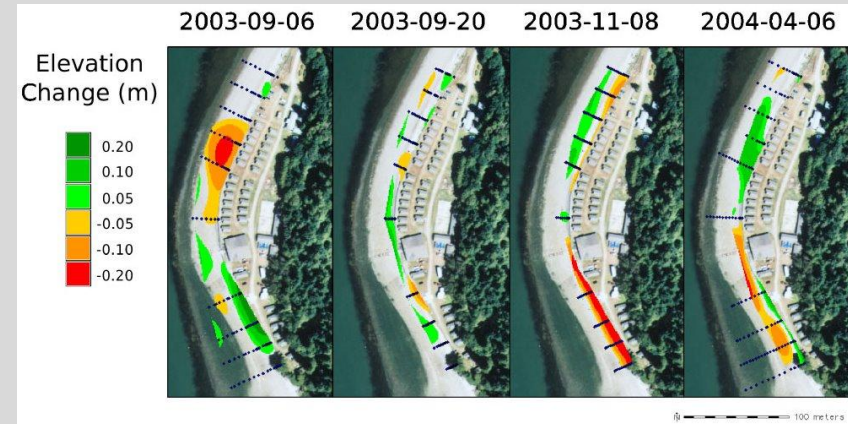
Armoring: Scientific Context

- **Puget Sound**

- Issue since 1970s
- Literature reviews (Ecology, AHG)
- Limited local studies, difficult to study
- Hard to apply work from elsewhere
- Recent interest by UW, USGS, Sea Grant, PSNERP, others.

- **National**

- Continuing debate on armoring in engineering and coastal management literature
- 2007 National Research Council Study
 - *Managing erosion on sheltered coasts*
- Increased concern related to possible future sea level rise



Armoring Workshop – May, 2009

- **3-day scientific workshop, held at Alderbrook on Hood Canal**
- **40 participants**
 - Local and regional scientists
 - National experts
- **23 Presentations**
 - Speakers asked to submit papers
 - Formal Proceedings, published by USGS
- **Public Symposium**
 - In Bremerton, day following workshop
 - Sponsored by PS Partnership
- **Primary Funding:** US Army Corps of Engineers, Planning Assistance to the States (PAS) Grant to WDFW

Puget Sound Shorelines and the Impacts of Armoring:
State of the Science
May 11-14, 2009

Public symposium with
Puget Sound Partnership,
Friday May 15th

Home
Workshop Description
Links
Program and Schedule
Abstracts / Presentations
Attendees

Workshop Objective:
This workshop convened regional and national experts to examine the state of the science relevant to shoreline armoring in environments similar to Puget Sound. Presentations addressed current understanding of Puget Sound, emerging scientific research on beaches and armoring, and relevant experience from other regions.

Due to space limitations and interest in maintaining an interactive workshop, participation was by invitation only.

US Army Corps of Engineers USGS UNIVERSITY OF WASHINGTON Puget Sound Partnership NOAA WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

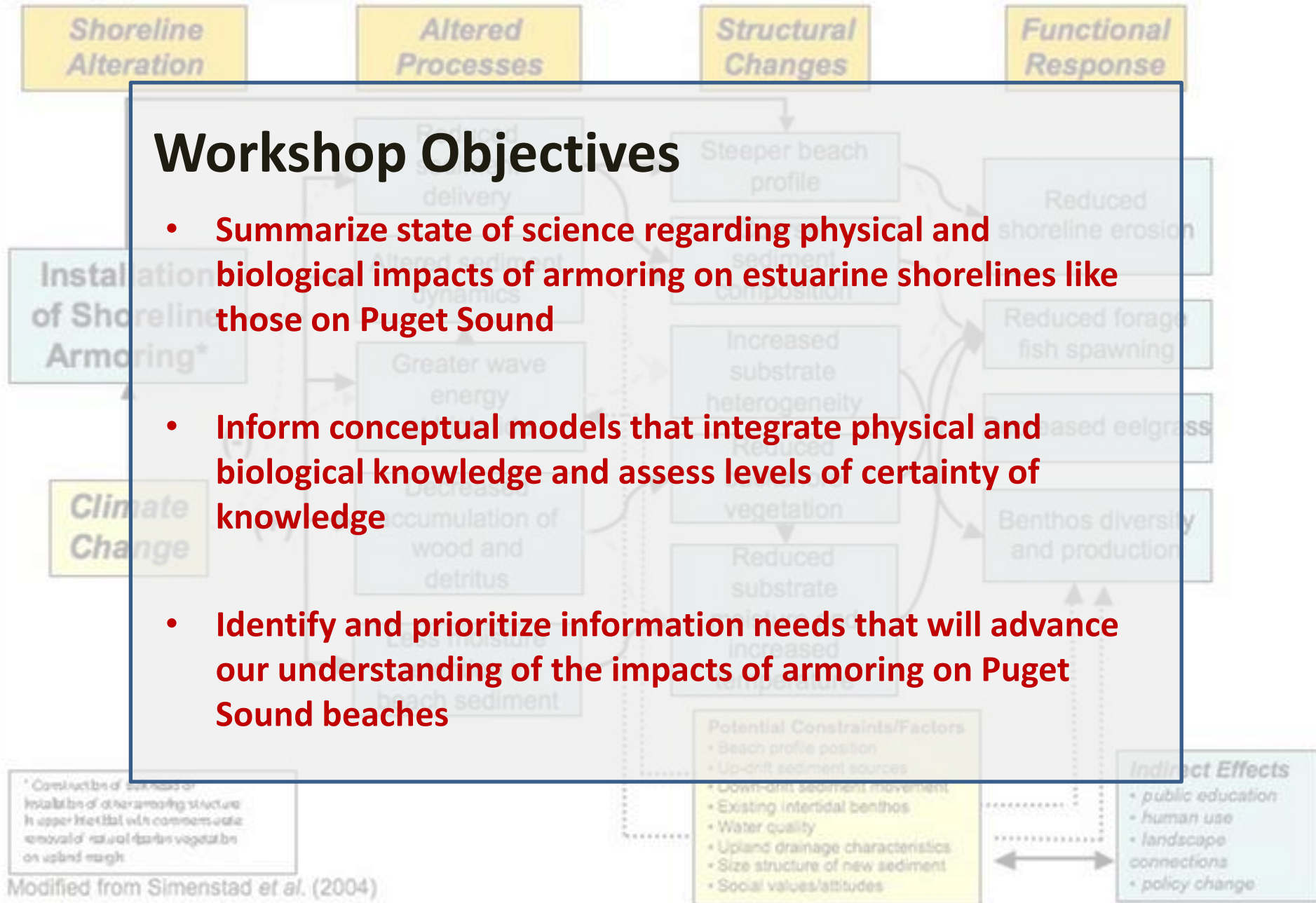


Shoreline Armoring Conceptual Model: State of the Science

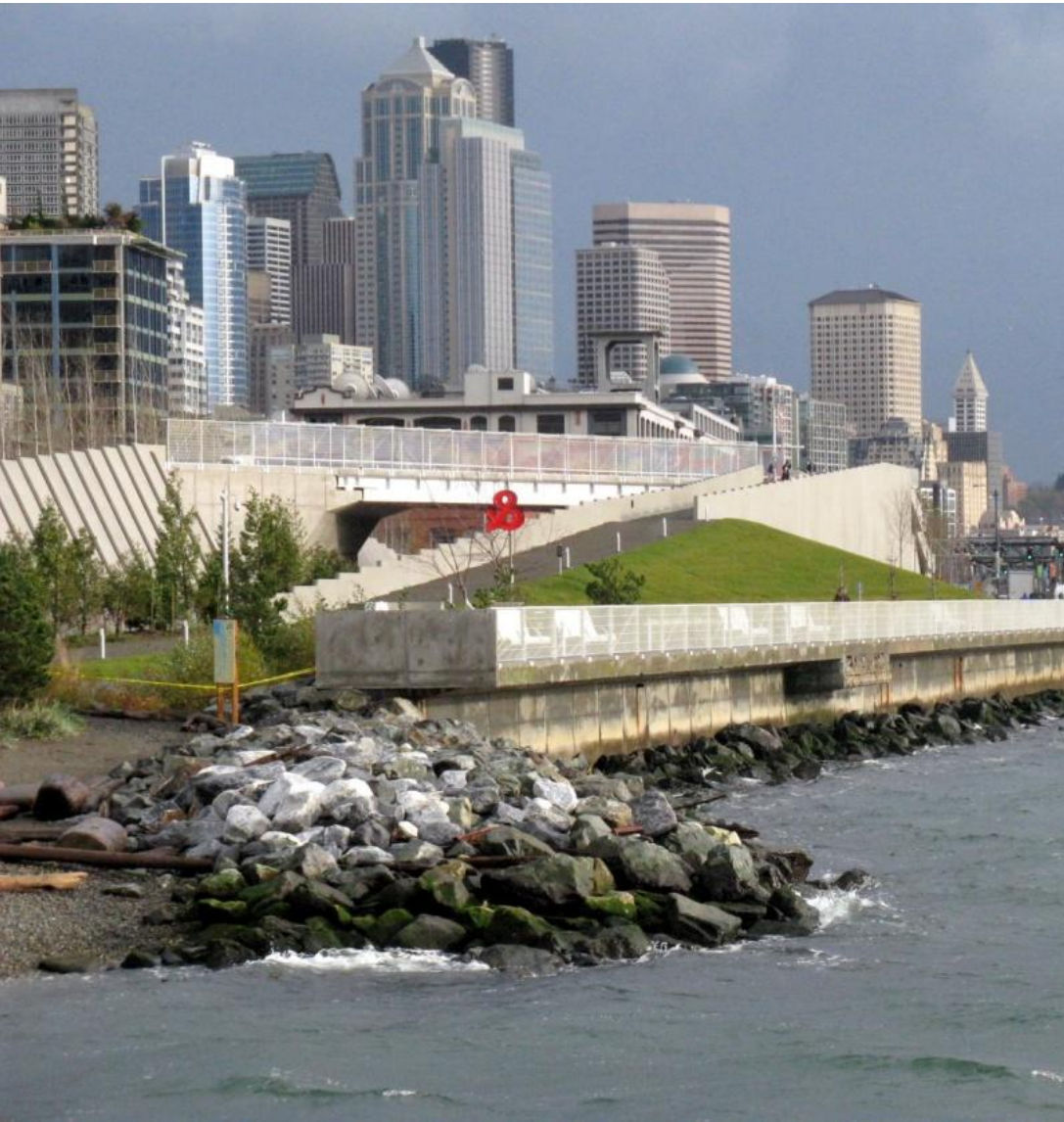
(dashed grey lines indicate considerable scientific uncertainty)

Workshop Objectives

- Summarize state of science regarding physical and biological impacts of armoring on estuarine shorelines like those on Puget Sound
- Inform conceptual models that integrate physical and biological knowledge and assess levels of certainty of knowledge
- Identify and prioritize information needs that will advance our understanding of the impacts of armoring on Puget Sound beaches



Workshop Organization



- **Puget Sound Setting and Context**
- **National Perspective and Human Dimensions**
- **Coastal Geologic and Oceanographic Processes**
- **Beach Processes and Ecological Response**
- **Management Needs**

Findings

- **Consensus on broad categories of impacts**
 - Recognition of common issues across wide range of geography, but often with very different flavors
 - Cumulative and long-term issue
- **Complex problem**
 - Impacts depend on geomorphic setting and location of structure
 - Importance of physical and biological connections
- **Poorly understood tradeoffs among ecosystem goods and services, private and public benefits**
- **Ramifications increase with rising sea level**
 - More armoring, greater impacts
- **Need for more research**
 - (this was a bunch of scientists, after all!)



Impacts of Shoreline Armoring

- **Placement Loss**
 - Direct loss of habitat, beach narrowing
- **Land-beach disconnection**
 - Isolation of aquatic and terrestrial environments, disruption of ecological processes
- **Sediment Impoundment**
 - Loss of terrestrial sediment sources, long-term beach loss within cell
- **Passive Erosion**
 - Long-term beach loss, increases with more rapid sea level rise
- **Active Erosion**
 - Changed substrate, beach erosion, increased disturbance

Massachusetts





Shoreline changes associated with coastal armoring

- 1) Placement loss
- 2) Passive erosion
- 3) Active erosion?

Different impacts in different places

- **Ecology**
 - Forage fish, Horseshoe crabs, Nesting turtles, Salmon, Shore birds, Seagrass, Marsh
- **Geology**
 - Bluffs, Spits and barrier beaches, Salt marshes
- **Oceanography**
 - Open ocean, sheltered coastlines
- **Structures**
 - Revetments, Bulkheads and seawalls, “Soft” structures, Artificial headlands and beaches
- **Management objectives**
 - Long-term beach loss, public access, ecological resources, erosion control and hazard reduction



Hawaii

Massachusetts



Geological – Biological Connections



Jenny Dugan/Dave Hubbard

Alternative Approaches to Erosion Control

- Strong interest among both managers and engineers in less-impacting methods of addressing eroding shorelines
- Objectives and designs differ from one region to another
 - Physical setting
 - Biological resources
 - Engineering designs
- Techniques
 - Living shorelines
 - Beach Nourishment
 - “Soft” structures



Workshop Outcomes

- **Valuable summary of current science as it applies to Puget Sound**
 - Up-to-date, peer-reviewed, and comprehensive
- **Affirmation of armoring as an important management issue**
 - Scientific issues validated, documented problems in other regions
- **Significant contribution to national discussion about armoring**
 - Particularly for sheltered coasts like Puget Sound
- **Improved collaboration among scientific community**
 - Both internal to Puget Sound and with scientists in other places
 - Geologists, biologists, and engineers talking to one another
- **Recognition that much more work is necessary:**
 - Physical and biological research
 - Social science and human dimensions
 - Engineering and alternative approaches
 - Education and outreach
 - Management and regulatory tools

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Shipman, Dethier, Gelfenbaum, Fresh, and Dinicola
USGS Special Investigations Report 2010-5254

- **Report Website**

- <http://pubs.usgs.gov/sir/2010/5254/>

- **Workshop Website**

- <http://wa.water.usgs.gov/SAW/index.html>

Internet Search: “Shoreline Armoring Workshop”

- **Hard Copies**

- Contact Hugh (hugh.shipman@ecy.wa.gov)

